Knowledge Management Success in an Engineering Firm

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Abstract

Does engineering organizations knowledge use organizations and engineers knowledge workers? This paper says positively and discusses the need for knowledge management in engineering organizations. Unfortunately, the knowledge management literature does not provide much guidance on how to measure the success or benefits of doing knowledge management in an engineering or other knowledge using organization. This paper discusses research that proposes a definition of knowledge management success and dimensions and measures that organizations can use to value knowledge management success. A case study of a nuclear utility engineering organization is used to illustrate how these dimensions and measures can be used to demonstrate the success of a knowledge management initiative/project.

Keywords

Knowledge Management; Knowledge; Management Success Measurement

Introduction

Knowledge workers defined by Davenport (2005) are those regarding knowledge as living and their main assets. Reinhardt et al. (2011) differentiated knowledge work from other forms of work through the primary task of "non-routine" problem , the solution to which requires a combination of convergent, divergent, and creative thinking. These definitions lead to the conclusion that engineers are knowledge workers performing knowledge work and engineering organizations are knowledge intensive organizations. Many knowledge intensive organizations utilize knowledge management (KM) to better manage their knowledge assets. Reasons to use KM come from a Jennex (2009) study on aging work forces who found that there is a great concern over the potential loss of knowledge due to retirement of engineers in the commercial nuclear industry. Also, Jennex (2006) reported NASA (National Aeronautic and Space Administration) due to the lack of KM practices has led to the loss of document based knowledge on how to build moon capable spacecraft. The observation is that engineering organizations need to successfully use KM to manage their knowledge. The research question investigated is that whetherthe Jennex-Smolnik-Croasdell definition of KM success can be confirmed when an engineering organization succeeds at KM or not. This is important as an organization must demonstrate when it does KM well. To answer this question, the paper presents a previously published case study of successful KM in a nuclear engineering organization and applies the Jennex-Smolnik-Croasdell measures of KM success to examine if it can be demonstrated that the KM program is successful.

KM Success Background

How to be successful with KM? Given the importance of knowledge to engineering organizations and the notable failure to capture knowledge as discussed above, it is important to answer this question. Initial research focused on the identification of critical success factors, CSFs, to initiate KM/KMS and the application of these CSFs to KM success models (Note: CSFs are areas in which satisfactory results ensure successful competitive performance and are the minimum key factors that an organization must have in order to achieve some goals (Alazami and Zairi, 2003)). Davenport, DeLong, and Beers (1998) identified four objectives for knowledge-based projects: create knowledge repositories, improve knowledge access, enhance knowledge environments, and manage knowledge as an asset. KM projects are successful when there is a growth in resources attached to the project, a growth in knowledge content, a likelihood that a project would survive without the support of a particular individual, and some evidence of financial return (Davenport, DeLong, and Beers, 1998). Jennex and Olfman (2005) surveyed the literature on KM and KM project success to generate a list of KM CSFs:

- A Knowledge Strategy that identifies users,

sources, processes, storage strategy, knowledge and links to knowledge for the KMS.

- Motivation and Commitment of users including incentives and training
- Integrated Technical Infrastructure including networks, databases/repositories, computers, software, KMS experts
- An organizational culture and structure that supports learning and the sharing and use of knowledge
- The wide knowledge structure of a common enterprise that is clearly articulated and easily understood
- Senior Management support including allocation of resources, leadership, and providing training
- Learning Organization
- There is a clear goal and purpose for the KMS
- Measures are established to assess the impacts of the KMS and the use of knowledge as well as verification that the right knowledge is captured
- The search, retrieval, and visualization functions of the KMS support easy knowledge use
- Work processes are designed that incorporate knowledge capture and use
- Security/protection of knowledge

Jennex and Olfman (2006) modified DeLone and McLean's (2003) IS Success Model to incorporate the KM CSFs listed above into a KM success model, see figure 1 (additionally Kundapur and Rodrigues, 2010, simulated the model to aid organizations in examining whether KM benefits will be found). This model uses KMS (system) quality, knowledge quality, and service quality as functional drivers for the use and impact of knowledge-based systems. KMS (system) quality refers to how well KMS perform with regard to its technical infrastructure and knowledge creation, storage, retrieval and application. Knowledge quality refers to the usefulness of knowledge artifacts in terms of their correctness and inclusion of contextual meaning as well as having appropriate linkages to knowledge. Service quality is a measurement of support for the systems in use. Performance impact is judged by the ability of these constructs to impart use of the systems and overall user satisfaction. Knowledge benefits are derived from the quality of the knowledge in the system and service dimensions associated with the system. Benefits are also a result of increased use and user satisfaction.

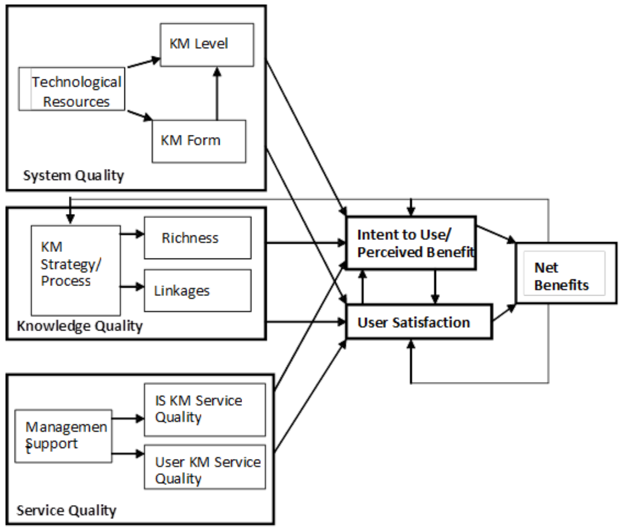

FIG. 1 JENNEX AND OLFMAN (2006) KM SUCCESS MODEL

Other literature identified similar factors that lead to success for KM related projects including flexible knowledge structures, knowledge-friendly culture, clear purpose and language, and multiple channels for knowledge transfer (Davenport, DeLong, and Beers, 1998; Bhatti, Zaheer, and Rehman, 2011). Additionally, research into why KM can fail identified issues similar to Jennex and Olfman (2005) and include capturing the wrong or obsolete knowledge, a KM strategy that does not address organizational needs; lack or conflicting leadership, and lack of incentives for knowledge sharing (Lam and Chua, 2005; Keramati and Azadeh, 2007; Weber, 2007; Jadoon and Hasnu, 2009; Bhatti, Zaheer, and Rehman, 2011).

However, KM impacts are not well understood. Common identified impacts in KM projects involved operational improvements for a particular process or function. These were hard to measure leading to further research into what defined KM success and how to measure that success. Jennex, Smolnik, and Croasdell (2009) utilized a literature generated survey to propose a definition of KM success and then surveyed KM academics and practitioners to determine if the proposed dimensions and their associated measures of KM success are valid. The proposed definition of KM success is:

"KM success is a multidimensional concept defined by capturing the right knowledge, getting the right knowledge to the right user, and using this knowledge to improve organizational and/or individual performance. KM success is measured by means of the dimensions: impact on business processes, strategy, leadership, and knowledge content." (Jennex, Smolnik, and Croasdell, 2009)

Jennex, Smolnik, and Croasdell (2012) attempted to

validate the above KM success definition through construction and administration of a survey. The measures for the survey that are used to operationalize the dimensions have been identified in the literature, and then validated via an expert panel of fifteen experts who were given the items and asked to identify the dimension to which the item was associated and if more items were needed for each dimension. Results of the expert panel have been used to adjust the wording and placement of the items, and to clarify what each dimension meant. The final items (incorporating the measures) were used to generate the survey and were:

Impact on Business Processes:

1. My last KM project improved the efficiency of the supported processes
2. My last KM project reduced costs for the supported business process
3. My last KM project had a positive return on investment for the supported processes
4. My last KM project improved the effectiveness of the supported processes.
5. My last KM project improved decision making in the supported processes
6. My last KM project improved resource allocation in the supported process

Impact on KM Strategy

1. My last KM project resulted in changes to my organization's KM goals
2. My last KM project resulted in the creation or modification of knowledge related key performance indicators
3. My last KM project resulted in changes to the way my organization assessed knowledge use in the organization
4. My last KM project resulted in changes in my organization's incentives for using and sharing knowledge
5. My last KM projected resulted in my organization increasing its awareness/mapping of knowledge sources and users
6. My last KM projected resulted in increased resources for our KM systems and repositories
7. My last KM project resulted in the creation of new or additional knowledge capture processes

Leadership/Management Support

1. My last KM project resulted in increased verbal/ political support for KM by top management
2. My last KM project resulted in increased financial support for KM by top management
3. My last KM project resulted in increased awareness of KM by top management
4. My last KM project resulted in increased use/reliance on KM by top management

Knowledge Content

1. My last KM project resulted in increased knowledge content in our repositories
2. My last KM project improved knowledge content quality of our repositories
3. Increased use or intention to use of knowledge content as represented by the following two items:
    a. My last KM project resulted in my increased use or intention to use of knowledge content
    b. My last KM project resulted in others increased use or intention to use of knowledge content
4. Increased identification of required knowledge and knowledge content sources as represented by the following two items:
    a. My last KM project resulted in my increased identification of required knowledge content and knowledge content sources
    b. My last KM project resulted in others increased identification of required knowledge content and knowledge content sources
5. Increased demand and/or searching for knowledge content as represented by the following two items:
    a. My last KM project resulted in my increased demand and/or searching for knowledge content
    b. My last KM project resulted in others increased demand and/or searching for knowledge content

Jennex, Smolnik, and Croasdell (2012) administered the survey to KM practitioners and scholars who were asked to respond based on their last KM project with the statement "your last KM initiative/project was considered successful" and they were then asked their agreement using a 7 point Likert scale on the above 25 constructs. The 88 responses were divided into two analysis groups. Those who responded agree (6) or strongly agree (7) that their last KM project/initiative was considered successful (57 responses) were placed in the agree group while all other respondents (31

responses) were placed in the non-agree group. Respondents who responded slightly agree (5) to the success of their last KM project/initiative were placed in the non-agree group to help make the groups more equal in number and because it was felt that those who responded slightly agree may be biased against reporting their project/initiative as a failure. Dimensions were analyzed using three methods: the highest score for the associated items; the average of the scores for the associated items; and the total number of associated items met with an item score of 6 or 7 needed to consider the item met. Scores were further analyzed to determine if the dimension was met for each response. Methods 1 and 2 determined whether the dimension was met and the score was greater than 5. Method 3 considered the dimension met and if at least half of the items scores were greater than 5. Finally, responses were analyzed by determining how many dimensions and total items were satisfied. Means for each of these were generated for each group and t-tests were used to determine if the differences between groups were significant.

TABLE 1 SURVEY RESULTS (AVG/(STD.DEV.)/(N)

Dimen-sion	High Value Method		Average Value Method		Item Count Method	
	Agree	Non-Agree	Agree	Non-Agree	Agree	Non-Agree
Impact on Bus Process	**6.4 (0.729)** (57)	5.6 (1.31) (32)	5.7 (0.705) (57)	4.7 (1.06) (32)	4.0 (1.67) (57)	2.1 (1.64) (32)
Impact on KM Strategy	6.2 (0.950) (57)	5.8 (0.898) (31)	5.0 (0.115) (57)	4.5 (0.891) (31)	3.3 (2.34) (57)	2.0 (1.84) (31)
Leadership/ Mgmt Support	6.0 (1.05) (57)	5.4 (1.33) (31)	5.2 (1.20) (57)	4.4 (1.31) (31)	1.9 (1.49) (57)	1.3 (1.38) (31)
Knowledge Content	6.3 (0.854) (53)	5.8 (1.08) (29)	5.4 (0.977) (53)	4.7 (1.12) (29)	4.6 (2.61) (53)	2.6 (2.23) (29)

TABLE 2 GROUP COMPARISONS

Dimensions and Items Met (Mean/(Std.Dev))			T-Test Comparison Between Groups: (Agree vs Non-Agree) Note all tests are significant	
Method	**Agree n=57**	**Non-Agree n=32**		
High Value	3.4 (0.9909)	2.7 (1.3102)	t_{51}=2.61	p < 0.01
Average Value	2.6 (1.3595)	1.3 (1.2854)	t_{64}=4.26	p < 0.01
Item Count	2.5 (1.3379)	1.4 (1.3664)	t_{60}=3.46	p < 0.01
Total Items (25 possible)	13.4 (6.71091)	7.7 (5.0902)	t_{79}=4.57	p < 0.01

The results were mostly as expected: the more successful the KM project/initiative was, the more the KM project/initiative measured items in more dimensions were. This suggested that the model of KM success is probably correct and that KM project/ initiative managers should use multiple measures in each of the four dimensions in order to measure success. A final analysis done was the splitting of the agreement group into agreement (41 responses answering 6 on project success) and strong agreement (16 responses answering 7 on project success) and t-tested to determine if the differences between these two groups were significant. This analysis yielded the most striking results as summarized in Table 3. Figures 2 and 3 visualize the findings from both analyses:

TABLE 3 STRONGLY AGREE VS AGREE DIMENSIONS AND ITEMS MET, (MEAN/(STD.DEV))

Method	Strongly Agree n=16	Agree n=41	t-test data
High Value	3.8 (0.5439)	3.2 (1.0701)	t_{51}=2.9787 p<0,01
Average Value	3.5 (1.0328)	2.3 (1.3233)	t_{35}=3.7243 p<0,01
Item Count	3.4 (0.8851)	2.3 (1.3398)	t_{41}=2.9997 p<0,01
Total Items (25 possible)	17.4 (6.1207)	11.9 (6.3332)	t_{28}=3.0513 p<0,01

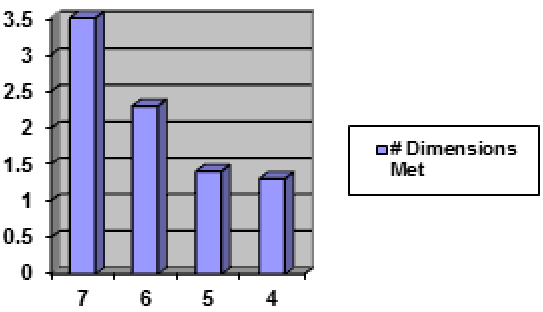

FIG. 2 DIMENSIONS MET VS SUCCESS (7 MOST SUCCESSFUL, 4 NOT SUCCESSFUL, 4 DIMENSIONS MAX)

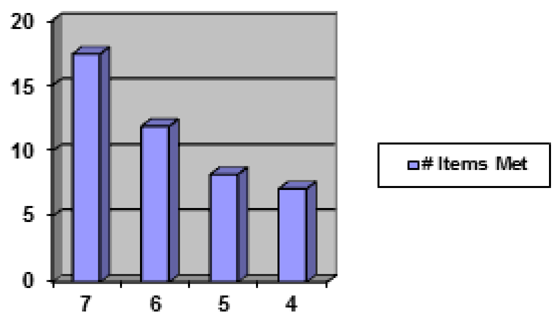

FIG. 3 ITEMS MET VS SUCCESS (7 MOST SUCCESSFUL, 4 NOT SUCCESSFUL, 25 ITEMS MAX)

These figures show that the more successful a KM project/initiative is perceived to be, the more

dimensions from the KM success definition and the more item measures from this study are met. Why are there more dimensions and items met for successful KM projects over those less successful? KM does not exist in an organizational vacuum, and it neither can be bolted onto an organization nor can it be done independent of the organization. Knowledge use and value only occurs within the context of the knowledge users and the organization. To be successful with KM, organizations need to fully understand what knowledge is needed, who needs it, how it is used, and why it is used. Successful KM projects/initiatives look for knowledge use and value in a large variety of ways. Knowing how to measure the KM project/ initiative definitely helps and that is the value of this research. Knowledge use and, thus, KM must impact the processes that they support. Improved processes impact leadership/management, with the purpose to guide the performance of organization at its best. Improved knowledge use drives the KM organization to modify their KM strategy to reflect how it works. Finally, like any resource, the organization strives to accumulate useful knowledge. The KM success definition recognizes that KM success is in getting the right knowledge to the right people at the right time. The dimensions recognize that being successful with KM will be reflected in these definitions as discussed above. While having a useful list of measures , they will be better understood if put into context. The rest of this paper is about the application of these measures to reevaluate a case study of KM in an engineering organization.

KM in an Engineering Organization

Organizational Background

The subject of engineering organization is part of a large, United States based, investor-owned utility. The utility, over 100 years old, with a service area of over 50,000 square miles, provides electricity to over 11 million people via 4.3 million residential and business accounts, with operating revenues of approximately $8.7 billion in 2002. The utility of net revenue has fluctuated wildly the last few years with a $2.1 billion loss in 2000, $2.4 billion in earnings in 2001 (primarily due to one time benefits from restructuring and other initiatives), and decreasing to $1.2 billion in earnings in 2002. To service its customers, the utility operates a transmission and distribution system and several large electrical generation plants and is organized into 3 main line divisions, Transmission and Distribution, Power Generation, and Customer Service. Divisions such as Human Resources, Security, and Information Technology (IT) support the line divisions. The utility has approximately 12,500 employees.

The Power Generation division is organized into operating units dedicated to supporting specific power generation sites. Each operating unit has line organizations such as Operations, Maintenance, Engineering, and Chemistry/Health Physics. Power Generation operating units are supported by dedicated units from the corporate support divisions (Security, Human Resources, IT). The engineering organization used for this case study is part of the nuclear operating unit of the Power Generation division and located at the largest electrical generation site operated by the utility. IT support is provided to this operating unit by Nuclear Information Systems (NIS) which administratively is part of the corporate IT division and operationally reports to both corporate IT and the nuclear unit of the Power Generation division. NIS supported engineering through its Engineering Support Systems group. This group consisting of a supervisor, two project manager/analysts, and two developers was tasked with the maintenance of the eleven systems under NIS control. New systems or enhancements on existing systems were done at the instigation of engineering. Engineering through a charge back process paid costs associated with these projects and developers were hired as needed to support the work.

At the time of the study, the engineering organization consisted of approximately 460 engineers disbursed among several different engineering groups reporting to the Station Technical, Nuclear Design Organization, Nuclear Oversight, and Procurement management structures. Industry restructuring has caused large drops in revenues driving the nuclear unit to reorganize engineering into a single organization consisting of 330 engineers under the management of the Nuclear Design Organization.

Basic KM Findings

The organization is driven to capture and use knowledge. Since it is a nuclear plant, it falls under the guidance of the United States Nuclear Regulatory Commission (NRC). The NRC mandates that nuclear plants learn from events so that they are not repeated. Each nuclear site has an independent safety engineering group tasked with reviewing events from other sites for applicability to their site. Additionally, knowledge on event experience is promulgated to each site through official NRC documents. However,

the result of this regulatory influence is that an inquiring and knowledge sharing culture is fostered throughout the nuclear industry. This site had an excellent knowledge sharing culture and interviews and surveys found that engineers were almost as likely to capture knowledge because they thought it a good idea as they were due to regulatory requirements.

The organization did not have a formal KM strategy or KMS when the case occurred, although by the end of the case a formal KM organization had been formed. However, the organization did have KMS repositories and components although they weren't recognized as such. The organization's knowledge was found to reside in four major locations: documents, databases, your memory, and others' memories. Interviews and surveys found several repositories such as email, the engineering library, the nuclear design database, the work management system, the corporate document management system, and the engineers' personal files (paper and electronic) and it was determined that this constituted the de facto KMS. A few changes in the KMS were noted over the course of the case. The most significant was a decrease in importance of email, which was attributed to changing the email system from CCMail to Lotus Notes. The change was performed without converting email archives with the effect that knowledge was lost. This experience taught the organization not to rely on email as a repository. Another important change was the reduction in the reliance on the "work done" sections of the work management system. Cost cutting process changes resulted in these sections stored in the Corporate Document Management system.

An important observation on KMS use was that amount of use was not a good indicator of the impact of KMS use. Several long term organizational members during interviews echoed the sentiment that it was not how often engineers used the KMS but rather that it was the one time that they absolutely had to find knowledge or found unexpected knowledge that proved the worth of the KMS. An example of this was the use of the KMS to capture lessons learned and best practices associated with refueling activities. These activities occurred on an approximate 18-month cycle that is sufficient time to forget what had been learned during the last cycle or to have new members with no experience taking over these activities.

Conclusions

Ultimately, Jennex (2008) found that the organization was successful in using the KMS to improve organizational performance although no specific success measures were identified that could show a direct causation between KM and improved organizational effectiveness. The next section will re-interpret the findings of this case study using the KM success definition previously presented. This definition and the measures proposed by Jennex, Smolnik, and Croasdell (2012) were not available when this case study was originally performed.

Applying The KM Success Definition

Jennex (2008) found indications that KM improved productivity in the nuclear engineering organization. These indications included a engineer productivity model and external validation based on an overall improving trend in capacity factor for the plants. The engineer productivity model shown in figure 4 shows how knowledgeis applied to the engineer tasks and what the outcomes are. Figure 4 will be re-analyzed using the KM success measures previously identified.

The first dimension is impact on business processes. There are 6 measures identified:

1. Improved the efficiency of the supported processes
2. Reduced costs for the supported business process
3. Positive return on investment for the supported processes
4. Improved the effectiveness of the supported processes.
5. Improved decision making in the supported processes
6. Improved resource allocation in the supported process

Review and inspection of figure 4 leads to the conclusion that KM in this engineering organization has caused improved process efficiency (using the quantitative measures of schedule, number of tasks completed, and priorities met); improved process effectiveness (using the qualitative measures of thoroughness and accuracy); improved decision making (client satisfaction measure of decision quality); and improved resource allocation (using the skill competency measures of task complexity, amount of supervision, and correctness). Additionally, Jennex (2008) discussed how the engineering organization was forced to reduce staff due to deregulation and how KM made this possible without the loss of organizational capability; resulting in reduced process costs. It is concluded that the first KM success dimension is met with 5 of the 6 measures being met.

The 6th measure was not met as the organization did not track investment costs in the initial informal KM initiative.

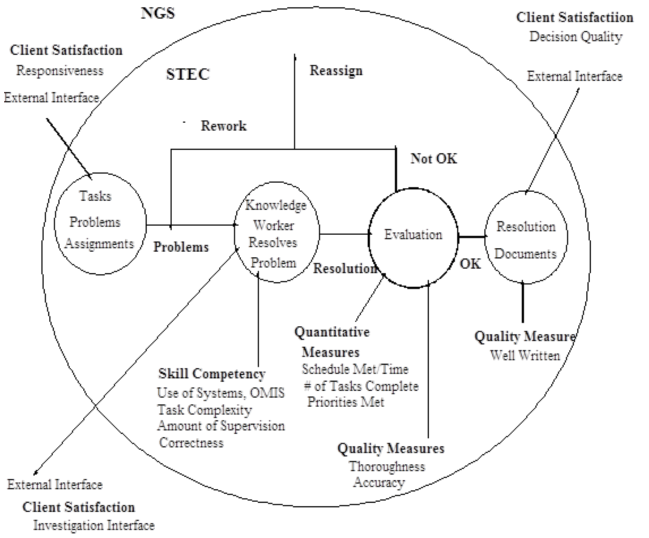

FIG. 4 ENGINEER PRODUCTIVITY MODEL

The second dimension is impact on KM Strategy with 7 measures:

1. Changes to my organization's KM goals
2. Creation or modification of knowledge related key performance indicators (KPIs)
3. Changes to the way my organization assessed knowledge use in the organization
4. Changes in my organization's incentives for using and sharing knowledge
5. Increasing its awareness/mapping of knowledge sources and users
6. Increased resources for our KM systems and repositories
7. Creation of new or additional knowledge capture processes

Jennex (2008 and 2008a) discussed what drove engineers to capture knowledge and how effective the KM tools were, both issues related to the measures of impact on KM strategy. Ultimately, it was concluded that the amount of use of the KMS was not a measure of KM/KMS success, rather it was the intent to use the KMS when appropriate that was a better measure. Key to intent to use was the perceived benefit model proposed by Thompson, Higgins, and Howell (1991) and perceived usefulness as described by Davis (1989). Perceived benefit and usefulness are both enhanced through KM strategy that focuses on ensuring that knowledge is captured supporting the knowledge users, in this case the engineers. Jennex (2008, 2008a) found that there were formal and informal drivers that led engineers to capture knowledge. These drivers form the basis of the KM strategy. Additionally, Jennex (2008) discussed how the organization formalized KM by creating a KM position. This dimension is met by achieving the measures of changing the organization's KM goals, creation of knowledge related KPIs, changes to how the organization assessed knowledge use in the organization, and increasing the resources for KM systems and repositories. Additionally, the engineer evaluation process was changed during the case study with focus more on collaboration and knowledge sharing and less on what the specific engineer knew. Finally, based on user feedback, the tools used to capture, store, search, and access knowledge were modified and improved. No data was collected to support an evaluation on increased awareness/ mapping other than the anecdotal experience of the author as the organization became aware of KM through the case study and thus becoming more aware of where there knowledge was. Then, Jennex (2008) provided evidence to support that 6 of the 7 measures were met and anecdotal evidence from the author supported the 7th measure.

The third dimension is Leadership/Management Support with 4 measures:

1. Increased verbal/political support for KM by top management
2. Increased financial support for KM by top management
3. Increased awareness of KM by top management
4. Increased use/reliance on KM by top management

Jennex (2008) discussed how support for doing the case study was provided by top engineering management through emails sent to each engineer. Additionally, the creation of a KM position is evidence of increased financial support for KM. Again, increased awareness by the Nuclear Regulatory Agency, NRC, during the period of the case study in addition to the support provided on KM to engineering management by the case study author increased the awareness of KM within management and the formal drivers to capturing and using knowledge increased the reliance of management on the knowledge repositories. It is concluded that this dimension is met and all four measures are supported.

The fourth dimension is Knowledge Content with 5 measures (reflected by 8 survey items)

1. Increased knowledge content in our repositories

2. Improved knowledge content quality of our repositories
3. Increased use or intention to use of knowledge content
4. Increased identification of needed knowledge content and knowledge content sources
5. Increased demand and/or searching for knowledge content

Jennex (2008) directly measured pratical use and found it significant, over 2 hours per day, and perceived benefit in the engineering organization and found that the engineers would use KM/KMS when appropriate. In addition, the previously mentioned drivers used to identify knowledge for capture and to drive what was captured were all found to be considered highly important by the engineers. Finally, the use of the engineer productivity model, figure 4, by management to assess the quality of engineer work resulted in improved knowledge quality and increased demand for knowledge content as expectations of engineer performance increased. It is concluded that this dimension was met and all 5 measures supported.

Conclusions

This paper reanalyzed the data from a longitudinal case study of knowledge management in an engineering organization in order to demonstrate that the dimensions and measures defined in Jennex, Smolnik, and Croasdell (2009, 2012) could be used to identify and measure KM success in a real organization. The longitudinal study originally concluded that KM led to an increase in organizational and individual productivity but failed to identify any measures that could directly link KM to this increase. This reanalysis found that 20 of these 22 measures were met and could have been used to measure the actual performance of KM projects/initiatives in the organization. This is significant in that it has demonstrated that these measures are those that engineering (or any other) organizations should identify and use to track KM project/initiative performance. The Jennex and Olfman (2006) KM success model is also recommended as a model to be used to design the KM project/initiative.

Then, this is significant as it is good management to expect that investments in systems and initiatives are able to demonstrate that anticipated and/or claimed benefits are generated and if the organization issuccessful. The economic downturn of 2008 has made management of resources critical and emphasized the need to demonstrate returns on investments and benefits. Prior KM literature has been very generic with respect to the measurement of knowledge use and KM. It is well known that we should re-use knowledge and that doing so should make us more effective, efficient, and cost effective. Prior to this paper, measures were not available to support these claims.

An organization does not have to show success in all the stated measures. Jennex, Smolnik, and Croasdell (2012) found that the KM initiative/projects perceived to be the most successful had 3.5 dimensions and 17 measures met while successful projects met 2.25 dimensions and 12 measures. It is concluded that the most successful KM initiative/projects are more aware of how to measure success than other KM initiatives/ projects. Still, it does mean that not all dimensions and measures need to be met; just as this case study did meet all 4 dimensions but not all the measures. Additionally, there may be additional measures not reflected in this paper. It is not expected that there will be additional dimensions but that should not preclude organizations from considering additional dimensions for assessing knowledge use and KM success. Repeatedly, organizations should use these dimensions and measures to value and demonstrate knowledge and KM success and benefits:

Impact on business processes (6 measures):

1. Improved the efficiency of the supported processes
2. Reduced costs for the supported business process
3. Positive return on investment for the supported processes
4. Improved the effectiveness of the supported processes.
5. Improved decision making in the supported processes
6. Improved resource allocation in the supported process

Impact on KM Strategy (7 measures):

1. Changes to my organization's KM goals
2. Creation or modification of knowledge related key performance indicators (KPIs)
3. Changes to the way my organization assessed knowledge use in the organization
4. Changes in my organization's incentives for using and sharing knowledge
5. Increasing its awareness/mapping of knowledge

sources and users

6. Increased resources for our KM systems and repositories
7. Creation of new or additional knowledge capture processes

Leadership/Management Support (4 measures):

1. Increased verbal/political support for KM by top management
2. Increased financial support for KM by top management
3. Increased awareness of KM by top management
4. Increased use/reliance on KM by top management

Knowledge Content (5 measures)

1. Increased knowledge content in our repositories
2. Improved knowledge content quality of our repositories
3. Increased use or intention to use of knowledge content
4. Increased identification of needed knowledge content and knowledge content sources
5. Increased demand and/or searching for knowledge content

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